

ORIGINAL ARTICLE

Association of Pain Quality with Pain Catastrophizing and Self-efficacy in People with Knee Osteoarthritis

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Objective: Patients with chronic pain often have symptoms similar to neuropathic pain (NeP). Such symptoms are also frequently observed in people with knee osteoarthritis (OA). However, pain quality may be related to psychological problems such as high pain catastrophizing and/or low self-efficacy. The objective of the current study was to investigate whether pain quality is associated with pain catastrophizing and self-efficacy in individuals with symptomatic knee OA. **Methods:** This was a cross-sectional study in which 50 subjects with symptomatic knee OA were enrolled. NeP scores were evaluated using the painDETECT questionnaire (PDQ), the pain catastrophizing scores were evaluated using the coping strategy questionnaire, and the self-efficacy scores were evaluated using the self-efficacy scale for rheumatoid arthritis (SERA). Participants were classified as members of the unlikely NeP group (PDQ score ≤ 12) or the uncertain/likely NeP group (PDQ score > 12). The pain catastrophizing scores and the self-efficacy scores were compared between the two groups. **Results:** Of the 50 participants, 17 (34%) were classified in the uncertain/likely NeP group. The pain catastrophizing score was higher for the uncertain/likely NeP group than for the unlikely NeP group ($P=0.03$). On the SERA scale, the self-efficacy for pain score was lower for the uncertain/likely NeP group than for the unlikely NeP group ($P=0.03$). **Conclusion:** High pain catastrophizing and low self-efficacy for pain control are significantly associated with the existence of an NeP component on PDQ in people with symptomatic knee OA.

Key Words: knee osteoarthritis; neuropathic pain; pain catastrophizing; self-efficacy

INTRODUCTION

Osteoarthritis (OA) is the most common painful musculoskeletal disorder. Clinical views have increasingly considered the possible neuropathic nature of OA-related knee pain.¹⁾ The International Association for the Study of Pain (IASP) defines neuropathic pain (NeP) as pain arising as a direct consequence of a lesion or disease affecting the somatosensory system.²⁾ Recognizing patients with knee OA who are experiencing pain with neuropathic features as a distinct subgroup would allow clinicians to implement optimal pain management strategies.

The pain quality of patients with NeP is known to be diverse compared with patients with nociceptive pain. Pain quality is screened using questionnaires. The painDETECT questionnaire (PDQ) was developed to screen for NeP.³⁾

However, there is a concern that the PDQ may result in a high number of false positives for NeP. Vaegter et al. compared the PDQ score with the IASP grading system and reported that of 55 patients identified as likely having NeP on the PDQ, 44 (80.0%) did not meet the criteria for NeP on the IASP grading system.⁴⁾ Therefore, there may be additional factors that affect pain quality other than the direct consequences of a lesion or disease affecting the somatosensory system.

Higher pain catastrophizing and lower self-efficacy have the potential to modify the perception of pain in patients with knee OA.⁵⁾ Pain catastrophizing refers to the tendency to focus on and magnify pain sensations and to feeling helpless to influence the pain experience.⁶⁾ Self-efficacy, on the other hand, refers to belief in one's capabilities to achieve a goal or an outcome.⁷⁾ It is possible that higher pain catastrophizing and lower self-efficacy are related to changes in pain quality.

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Therefore, the aim of the current study was to investigate whether the assessed pain quality was associated with pain catastrophizing and self-efficacy in individuals with symptomatic knee OA.

METHODS

Patients

The inclusion criteria for patient selection were a positive diagnosis of knee OA (provided by an orthopaedist based on radiographic assessment) and knee pain on daily activities. The exclusion criteria were the presence of articular rheumatism, total arthroplasty, or the inability to complete questionnaires independently because of cognitive impairment (e.g., dementia).

Main Outcome Variable

Pain catastrophizing was assessed using the Japanese version of the coping strategy questionnaire (CSQ).⁸⁾ The CSQ is composed of six subscales evaluating cognitive strategies related to the experience of pain and two subscales evaluating behavioural strategies. Of these, the subscales for measuring catastrophizing were used in this study. This pain catastrophizing assessment consisted of two items measured with a numerical rating scale ranging from 0 (never do that) to 6 (always do that), indicating how frequently the strategies are used to cope with pain. The Japanese version of the CSQ has good internal consistency.⁸⁾

Self-efficacy was assessed using the self-efficacy scale for rheumatoid arthritis (SERA) developed by Sasano et al.⁹⁾ SERA consists of two subscales evaluating self-efficacy related to daily activity and self-efficacy related to pain. The self-efficacy subscales consist of seven and eight items measured with a numerical rating scale ranging from 1 (never do that) to 5 (always do that). The Japanese version of SERA has good internal consistency and high criterion validity.⁹⁾

To clarify the participants' characteristics, the ranges of motion of the hip and knee joint, the knee extension muscle strength, and the total number of stand/sit cycles achieved within 30 s (30CST) were measured. Muscle strength was measured using a hand-held dynamometer (MT-100, SAKAI Medical Company, Tokyo, Japan).

Study Factors

The NeP component was identified using the Japanese version of the PDQ.¹⁰⁾ The PDQ includes the total score and the main component score which consists of seven questions that address the quality of NeP symptoms. The total PDQ

score can range between -1 and 38. The following cut-off scores were used to identify the likelihood of an NeP component: a score ≤ 12 indicates that the pain is unlikely to have a neuropathic component, and a score of ≥ 19 indicates that the pain is likely to have a neuropathic component. The Japanese version of the PDQ has excellent test-retest reliability and good internal consistency.¹⁰⁾

Procedures

Participants were recruited through a convenience sampling method of patients receiving physical therapy at Sakamidorii Hospital, Midorii Orthopedic Hospital, and Oasa Furusato Hospital between April 2014 and February 2015. Questionnaires were distributed during participants' physical therapy visits, and the completed questionnaires were returned to the researchers. To reduce the measurement bias, the first author, who ideated the study hypothesis, did not engage in the recruitment of study subjects or in data collection. The subjects and the hospital staff who collected the data were not informed of the study hypothesis until the study was completed. This study was approved by the ethics committees of both participating hospitals.

Statistical Analysis

Using the methods of Hochman et al.,¹¹⁾ participants were classified into an unlikely NeP group (PDQ score ≤ 12) and an uncertain/likely NeP group (PDQ score > 12). In total, 92% of individuals with a PDQ score ≤ 12 were classified as unlikely to have NeP using the IASP grading system.⁴⁾ In this study, we examined the following hypothesis: The score of pain catastrophizing is higher in the uncertain/likely NeP group than in the unlikely NeP group.

The minimum sample size was calculated using G*Power version 3.1.5, a software program (Kiel University, Kiel Germany). Hochman et al. reported that the proportion of patients with knee OA with PDQ scores > 12 was 37%.¹¹⁾ Based on this finding, the allocation ratio was set at 1 (37%) in the uncertain/likely NeP group to 1.7 (63%) in the unlikely NeP group. A one-sided test was selected. The effect size d was set at 0.8, the alpha value was set at 0.05, and the power was set at 0.8. Consequently, for the independent t -test, a minimum of 28 subjects were required in the unlikely NeP group and 16 subjects were required in the uncertain/likely NeP group, giving a total of 44 subjects. For the Mann-Whitney U test, 32 people were required in the unlikely NeP group and 16 people in the uncertain/likely NeP group, giving a total of at least 48 subjects.

Pain catastrophizing and self-efficacy scores were com-

pared between the two groups. The selected tests for the comparison were the independent *t*-test or the Mann-Whitney U test. If the normal distribution of data was not confirmed, the Mann-Whitney U test was conducted. To confirm the normal distribution of data, the Shapiro-Wilk test was performed. To investigate whether pain intensity was significant as a confounding factor, correlation analysis among variables was performed. If there were subjects with missing data, Little's test was performed to determine whether data was missing completely at random.¹²⁾ All analyses were performed using SPSS Version 22 (IBM SPSS, Tokyo, Japan).

RESULTS

A total of 50 people participated in the current study. Based on PDQ scores, 33 participants (66%) were allocated to the unlikely NeP group and 17 (34%) were allocated to the uncertain/likely NeP group. In the uncertain/likely NeP group, 6 participants (12% of 50 participants) had a PDQ score ≥ 19 . The relevant characteristics of participants are reported in **Table 1**. The age was higher and the total number of stand/sit cycles executed within 30 s was lower in the uncertain/likely NeP group than in the unlikely NeP group ($P < 0.05$).

The pain catastrophizing and self-efficacy scores are presented in **Table 2**. There were no missing values. For our sample group, Cronbach's alpha values were > 0.8 for all subscales. Correlation analysis showed that the pain intensity was not always strongly correlated with the association between pain quality, self-efficacy, and catastrophizing. The Shapiro-Wilk test indicated that the pain catastrophizing and self-efficacy scores were not normally distributed. Therefore, the Mann-Whitney U test was selected for the score comparison. The pain catastrophizing score was higher for the uncertain/likely NeP group than for the unlikely group ($P = 0.03$). The self-efficacy for pain score was lower for the uncertain/likely NeP group than for the unlikely NeP group ($P = 0.03$).

DISCUSSION

Within our study group of 50 subjects, 34% were classified as having uncertain/likely NeP components. The pain catastrophizing and self-efficacy for pain scores were significantly different between the uncertain/likely NeP group and the unlikely NeP group. Our results suggested that pain catastrophizing and self-efficacy for pain are associated with the quality of NeP symptoms in individuals with symptomatic knee OA.

The ratio of uncertain NeP to likely NeP as classified using the PDQ in people with knee OA has been evaluated in previous studies. Ohtori et al. reported that the proportion of PDQ scores > 12 was 20.6% in their sample and the proportion of scores ≥ 19 was 5.4%.¹³⁾ Hochman et al. reported that the proportion of PDQ scores > 12 was 37% and the proportion of scores ≥ 19 was 11%.¹¹⁾ There is wide variance in the ratio of uncertain to likely NeP. In our study group, 17 (34%) participants had a PDQ score > 12 and 6 (12%) had a score ≥ 19 , a ratio similar to those reported above^{11,13)}. Therefore, we considered our study group to be representative of the general population of people with knee OA.

A significant proportion of subjects with chronic pain associated with knee OA were found to have NeP qualities.¹⁴⁾ Chronic pain is known to be associated with decreased prefrontal and thalamic gray matter density.¹⁵⁾ Bilateral activation of the anterolateral prefrontal cortex has been shown to influence the cognitive control of pain.¹⁶⁾ These findings suggest that cognitive factors are likely associated with NeP. In the current study, both high catastrophizing and low self-efficacy for pain were associated with high PDQ scores. This finding may explain the false positive identification of NeP using the PDQ.

There is evidence based on randomized control trials supporting the use of cognitive intervention or self-management programs to improve pain catastrophizing and self-efficacy in people with knee OA. Somers et al. reported that combined pain coping skills training and lifestyle behavioural weight management intervention was effective in reducing pain catastrophizing and improving self-efficacy in overweight and obese people with knee OA.¹⁷⁾ Hunt et al. provided evidence of the effectiveness of intervention combining physical exercise and pain coping skills training in yielding statistically significant improvements in pain control coping.¹⁸⁾ Yip et al. reported that an arthritis self-management program combined with an exercise component improved self-efficacy for pain.¹⁹⁾ Further, considering our results, we propose that cognitive intervention or self-management programs would likely be beneficial, especially for people with knee OA and suspected NeP (such as central sensitization²⁰⁾) who had no beneficial response to drug therapy, as for example with the use of pregabalin for NeP.

Our study has several limitations which must be considered in the interpretation of findings for practice. First, the study design was cross-sectional and so the study cannot be used to draw conclusions about a strict causal relationship between pain quality and psychological problems. Our results suggest the possibility that high pain catastrophizing

Table 1. Characteristics of the participants

		Unlikely NeP group (PDQ ≤12)	Uncertain/likely NeP group (PDQ >12)	P
Number (%)		33 (66%)	17 (34%)	
Age (year)		73 (66, 80)	81 (75, 84)	0.01 [†]
Gender (number of women)		23	14	0.53 [‡]
Height (cm)		153.5 (148.1, 156.1)	150.0 (146.0, 157.5)	0.51 [†]
Body weight (kg)		54.0 (47.1, 62.5)	52.8 (48.3, 61.0)	0.81 [†]
K-L grade	1	4	1	0.31 [‡]
	2	17	6	
	3	5	7	
	4	3	2	
	Unknown	4	1	
OA	Spine	11	9	0.30 [‡]
	Hip	3	1	1.00 [‡]
Complication (number)	Diabetes	4	2	1.00 [‡]
	Hypertension	13	8	0.83 [‡]
	Renal failure	0	1	0.73 [‡]
	Cerebral vascular disorder	2	1	1.00 [‡]
	Gastrointestinal bleeding	1	0	1.00 [‡]
Range of motion (degrees)	Hip flexion, Rt	120 (110, 120)	120 (110, 120)	0.87 [†]
	Hip IR, Rt	30 (20, 40)	30 (20, 40)	0.72 [†]
	Hip ER, Rt	45 (40, 50)	50 (40, 55)	0.65 [†]
	Knee flexion, Rt	140 (125, 145)	140 (130, 145)	0.78 [†]
	Knee extension, Rt	0 (−5, 0)	−5 (−10, 0)	0.10 [†]
	Hip flexion, Lt	120 (115, 120)	120 (115, 125)	0.42 [†]
	Hip IR, Lt	30 (25, 40)	30 (25, 40)	0.93 [†]
	Hip ER, Lt	45 (40, 50)	40 (40, 55)	0.70 [†]
	Knee flexion, Lt	140 (130, 150)	140 (125, 145)	0.34 [†]
	Knee extension, Lt	0 (−5, 0)	−5 (−10, 0)	0.06 [†]
Muscle strength (N/kg)	Knee extension, Rt	84.2 (70.2, 105.4)	73.4 (48.2, 95.1)	0.17 [†]
	Knee extension, Lt	81.7 (66.3, 101.0)	73.4 (49.6, 83.1)	0.08 [†]
30CST		11 (10, 14)	8 (6, 12)	0.02 [†]

K-L, Kellgren-Lawrence; Rt, right; Lt, left; IR, internal rotation; ER, external rotation; 30CST, 30-s chair stand test; [†]Mann-Whitney U test; [‡]Chi-square test.

Data are medians with the interquartile range in parentheses.

Table 2. The pain catastrophizing and self-efficacy scores

Subscales		Cronbach's alpha	Unlikely NeP group (PDQ ≤12)	Uncertain/likely NeP group (PDQ >12)	P [†]
Pain catastrophizing (CSQ)		0.857	4 (3, 6)	7 (6, 8)	0.03
Self-efficacy (SERA)	Daily activity	0.888	29 (27, 32)	23 (22, 27)	0.07
	Pain	0.898	23 (22, 27)	21 (21, 24)	0.03

[†]Mann-Whitney U test.

Data are medians with the interquartile range in parentheses.

and low self-efficacy for pain control complicate the way in which people with an uncertainly/likely NeP component feel their pain. This possibility should be re-examined in a longitudinal study in the future. Second, this study included Japanese subjects only. Moreover, our sample group included a higher proportion of women and the subjects were older than those in other reported studies of pain with knee OA. The mean age of our study group was 74 years, with 72% being women, compared with other study groups which have included an age range from 55 to 74 years and with a proportion of women ranging between 48.9% and 100%.²¹⁾ Possible sampling bias in our study group might limit the application of findings to a general population. Third, we used SERA as a measure of self-efficacy. SERA was developed using a uniquely Japanese population.⁹⁾ To validate our findings, future studies should include international scales of self-efficacy, such as the arthritis self-efficacy scale.²²⁾ Fourth, we did not include a gold standard method to evaluate NeP, such as the evaluation of differences in sensory characteristics.⁴⁾ Consequently, our conclusions are limited to the fact that there are some associations between scores on the three self-report measures. Future longitudinal studies using gold standard methodologies are required to conclusively evaluate the association of pain quality with catastrophizing and self-efficacy for pain.

CONCLUSIONS

High pain catastrophizing and low self-efficacy for pain control were significantly associated with the existence of an NeP component on PDQ in people with symptomatic knee OA.

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CONFLICTS OF INTEREST

The authors report no conflicts of interest.

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